

Appl. No. 10/711,015
Amdt. dated September 07, 2005
Reply to Office action of June 30, 2005

Amendments to the Claims:

1. (Currently amended) A copper damascene process, comprising:
forming a dielectric layer overlying a substrate;
etching a damascene__opening into said dielectric layer;
5 filling said damascene opening with copper or copper alloy;
treating a surface of said copper or copper alloy with hydrogen-containing plasma;
reacting said treated surface of said copper or copper alloy with trimethylsilane or
tetramethylsilane under plasma enhanced chemical vapor deposition (PECVD)
conditions; and
10 in-situ depositing, by PECVD, a silicon carbide layer capping on said copper or
copper alloy.
2. (Original) The copper damascene process according to claim 1 further comprising:
lining said damascene opening with a diffusion barrier layer;
15 forming a seed layer on said diffusion barrier layer; and
forming said copper or copper alloy on said seed layer.
3. (Original) The copper damascene process according to claim 1 wherein said
damascene opening comprises a contact or via hole in communication with a trench
20 opening.
4. (Original) The copper damascene process according to claim 1 wherein the step of
reacting said treated surface of said copper or copper alloy with trimethylsilane or
tetramethylsilane comprises following processing parameters: a trimethylsilane (or
25 tetramethylsilane) gas flow in the range of 100 to 5000 sccm; a process temperature in
the range of 300°C to 450°C; and a reaction duration in the range of 0.1 seconds to 30
seconds.

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5. (Currently amended) A copper damascene process, comprising:
forming a dielectric layer overlying a substrate;
etching a damascene opening into said dielectric layer;
5 filling said damascene__opening with copper or copper alloy;
treating a surface of said copper or copper alloy with hydrogen-containing plasma;
reacting said treated surface of said copper or copper alloy with trimethylsilane or
tetramethylsilane under plasma enhanced chemical vapor deposition (PECVD)
conditions; and
10 in-situ depositing, by PECVD, a silicon carbide layer capping on said copper or
copper alloy, said ~~layer~~ silicon carbide layer being treated with in-situ ammonia plasma to
remove contained oxygen of the deposited layer.
6. (Original) The copper damascene process according to claim 5 further comprising:
15 lining said damascene opening with a diffusion barrier layer;
forming a seed layer on said diffusion barrier layer; and
forming said copper or copper alloy on said seed layer.
7. (Original) The copper damascene process according to claim 5 wherein said
20 damascene opening comprises a contact or via hole in communication with a trench
opening.
8. (Original) The copper damascene process according to claim 5 wherein the step of
reacting said treated surface of said copper or copper alloy with trimethylsilane or
25 tetramethylsilane comprises following processing parameters: a trimethylsilane (or
tetramethylsilane) gas flow in the range of 100 to 5000 sccm; a process temperature in
the range of 300°C to 450°C; and a reaction duration in the range of 0.1 seconds to 30
seconds.